

Drs. Loosli
Sommers
Wyatt

Physiology of Respiratory System

#908

THE COUNCIL FOR TOBACCO RESEARCH - U.S.A., INC.

110 EAST 59TH STREET
NEW YORK, N.Y. 10022
(212) 421-8885

FEB 21 1973

Application for Research Grant
(Use extra pages as needed)

RECEIVED

Date: 2-15-73

1. Principal Investigator (give title and degrees):

Sanford E. Leeds, M.D.

2. Institution & address:

Mount Zion Hospital and Medical Center
1600 Divisadero Street
San Francisco, California 94115

3. Department(s) where research will be done or collaboration provided:

Experimental Surgery Laboratory

4. Short title of study:

Role of the pulmonary lymphatics in the absorption of inhaled particles
and gases

5. Proposed starting date: July 1, 1973

6. Estimated time to complete: 3 years

7. Brief description of specific research aims:

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7. Brief description of specific research aims

In order to understand the impact of air pollution on the human organism it is necessary to understand the route of absorption and the physiologic and pathologic effects of inhalation of particles and gases. An important and little understood pathway in the body for absorption of air pollutants is the extensive network of lymphatics in the lungs. The purpose of the experiments to be outlined is to study the absorption of non-toxic and toxic inhaled materials by the lungs with emphasis on the role of the lymphatic channels.

In general, our objective is to study the role of the pulmonary lymphatics in the absorption of inhaled particles and gases. The specific objectives are three-fold:

- (1) To measure the amount of radioactive particles and gases in pulmonary lymph. This will quantitatively demonstrate the absorption of particles and gases by the pulmonary lymphatics.
- (2) To determine the number and type of cells in right duct (RD), i.e., pulmonary lymph, and thoracic duct (TD) lymph after inhalation of particles and gases (irritant and non-irritant).
- (3) To measure the flow and composition (cellular and chemical) of the hilar lymphatics. Lymph from these lymphatics is purely pulmonary without admixture of pericardial, cardiac, or other sources of lymph.

8. Brief statement of working hypothesis

The anatomic pathway from alveoli to lymphatics has been summarized by Yoffey and Courtice (1). Physiologic studies, such as those of Chinard (2), Schultz (3), and others, have demonstrated that absorption of various test substances into pulmonary capillaries occurs during the respiratory cycle when particle size and other factors are favorable.

The role of lymphatics in the absorption of RISA from the alveoli was studied by Meyer *et al* (4) who found that absorption of RISA by pulmonary capillaries was greater than that by the lymphatics. Since this is the only publication dealing specifically with pulmonary lymphatics, further studies seem desirable.

We, in this laboratory, have developed techniques for collecting pulmonary and systemic lymph which will permit quantitation of the uptake of absorbed particles (5,6). We also have initiated studies of the cell content of lymph from the right duct and thoracic duct of dogs (7). The proposed study will have practical application for control of air pollution by clarifying our understanding of basic mechanisms involved in the absorption and fate of inhaled particles and gases.

9. Details of experimental design and procedures

- (1) Measurement of lymph flow and composition* of lymph from the RD and TD and blood serum after
 - (a) endobronchial instillation of radioactive iodinated serum albumin (RISA);
 - (b) inhalation of nebulized radio-aerosols in which the size and

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concentration of the aerosols particles is known. It is planned to use the following isotopes and labeled microspheres: (i) Small microspheres (0.25-3.0 μ) labeled with I¹²⁵; (ii) Serum albumin tagged with I¹³¹ or I¹²⁵; (iii) Xenon gas; (iv) C¹⁴; (v) Mono-dispersed fluorocarbon resin particles tagged with 18F.

- (2) Measurement of lymph flow and composition* of lymph from RD and TD after inhalation of

- (a) irritant gases,
- (b) irritant dusts.

- (3) Radioautographs of lung to show fate of radioactive particles and gases.

*Analysis of composition of lymph includes the following: Chemical composition - electrolytes, protein, oxygen, enzymes, etc., and cellular composition - total cell count and differential count. Radioactivity is measured when indicated.

All experiments employ dogs. Endobronchial instillation of RISA is by bronchoscopy and the introduction of a 16 gauge polythene catheter (Cobe Catheter Co.) into each main stem bronchus. Two ml RISA are injected directly into the right and left main stem bronchus followed by 2 ml saline to wash out the catheter. A cuffed endobronchial tube is inserted immediately on removing the bronchoscope in order to avoid loss of RISA. In other experiments radio-aerosols are administered. The size and concentration of the aerosol particles are regulated. For this purpose a respirator is used with nebulizer, filter and exhalation manifold. When irritating particles and gases are administered the animal is placed in a fume hood.

The method of cannulation of the pulmonary lymphatics (RD) has been described by Leeds *et al* (5). Briefly, the RD and TD are cannulated in the neck, the chest is not opened. Evans blue dye (T-1824) is instilled into the right lung in order to aid in visualizing the leash of fine lymphatics which makes up the RD. A segment of the right external jugular and subclavian veins into which the pulmonary lymphatics drain is isolated by dissection and ligation, taking care to preserve the lymphatics. The segment of the external jugular vein is then cannulated and the entire pulmonary lymph drainage, except for a portion from the left upper lobe, is collected. This is an improvement over the method of Warren and Drinker (8) published in 1942, in which one small lymphatic was cannulated and only a small portion of the pulmonary flow obtained. The TD is cannulated in the neck near its junction with the venous system. Five hourly samples of lymph from the RD and TD are usually collected for measurement of rate of flow and for analysis.

Scintillation counts are done by the Department of Nuclear Medicine under the direction of Dr. Kenneth R. McCormack to determine radioactivity in 1 cc samples of lymph. The remaining lymph samples are used for chemical tests and cellular determinations. Blood is drawn at hourly intervals and radioactivity of 1 cc aliquots of serum are measured.

The method of counting cells has been described by Leeds *et al* (7). The cell counts and differential counts of morphologic types are performed in the Immunology Research Laboratory under the direction of Dr. Ernest H. Rosenbaum,

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The technique of cannulation of hilar lymphatic is similar to that employed for cannulation of a cardiac lymphatic (Leeds *et al* (9)). Evans blue dye (T-1824) is injected into the lung parenchyma distally and the hilar lymphatics are thus visualized. Using a Zeiss operating microscope for magnification, a fine polythene tube is inserted into an isolated lymphatic and tied in place with 6-0 Deknatel silk. The polythene catheter is washed with dilute heparin solution prior to insertion. Lymph samples are collected hourly to measure rate of flow and to study cellular and chemical characteristics. Following instillation or inhalation of radioactive materials, radioactivity of the lymph is measured by the Nuclear Medicine Laboratory.

Noxious gases and irritant particles are administered by aerosol nebulizer in a fume hood into which the anesthetized dog is placed. Radioautographs are done by standard methods when indicated.

10. Space and facilities available

These include a modern experimental surgery laboratory, opened in 1963, with four operating tables each with piped-in suction, air and oxygen, special lights and Bird respirator. Large preparation and work rooms adjoin. In addition, there is an individual room for the use of the investigators and technician personnel which contains benches, desk, record files, book shelves, storage cupboards and drawers for special equipment. Major items of permanent equipment include an x-ray room complete with equipment for roentgenography and fluoroscopy, pumps and oxygenators, electrocardiograph, electronics for medicine, and other recording devices and manometers and a Zeiss operating microscope. The latter is equipped with camera and Strobe light for rapid exposures.

In addition, the facilities of the Division of Nuclear Medicine are available for determinations of radioactivity in blood and lymph and for scintillation scans and radioautographs of the lung. The facilities of the Immunology Research Laboratory are available for cell counts of lymph, hematologic and immunologic (e.g., electrophoresis) studies. The facilities of the Pulmonary Laboratory are available for administration of aerosol particles and gases. The personnel of these three sections collaborate closely with the principal investigator and his associates in a team effort. All the above facilities are under one roof - the Mount Zion Hospital and Medical Center.

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Biographical sketches of investigators and other professional personnel (append)

Publications

1. Leeds SE, Uhley HN, Sampson JJ, Friedman M: A new method for measurement of lymph flow from the right duct in the dog. Am J Surg 98:211, 1959.
2. Leeds SE, Uhley HN, Sampson JJ, Friedman M: Significances of changes in the pulmonary lymph flow in acute and chronic experimental pulmonary edema. Am J Surg 114:254, 1967.
3. Ortega P, Uhley HN, Leeds SE, Friedman M, Sampson JJ: Serial electron and light microscopic studies in the dog lung in chronic experimental pulmonary edema. Am J Path 60:57, 1970.
4. Leeds SE, Reich SB, Uhley HN, Sampson JJ, Friedman M: The pulmonary lymph flow after irradiation of the lungs of dogs. Chest 59:203, 1971.
5. Leeds SE, Uhley HN, Basch CM, Rosenbaum EH, Yoffey JM: Comparative study of lymph and lymphocytes of the thoracic and right lymphatics ducts. I. Normal dogs. Lymphology 4:53, 1971.
6. Uhley HN, Leeds SE, Sung AM: The subendocardial lymphatics of the canine heart - A possible role of the lymphatics in the genesis of conduction disturbances and arrhythmias. Am J Cardiol 29:367, 1972.
7. Mann PEG, Cohen AB, Finley TN, Ladman AJ: Alveolar macrophages. Structural and functional differences between nonsmokers and smokers of marijuana and tobacco. Lab Invest 25:111-120, 1971.

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14. First year budget:

A. Salaries (give names or state "to be recruited") % time Amount
Professional (give % time of investigator(s)
even if no salary requested)

Sanford E. Leeds, M.D.	Principal Investigator	30
Philip E.G. Mann, M.D.	Co-Investigator	20
Herman N. Uhley, M.D.		5
Theodore N. Finley, M.D.		5
Kenneth R. McCormack, M.D.		5
Ernest H. Rosenbaum, M.D.		5

Technical

Vaida Hoffman, R.N.,	Technician II	100
To be recruited	Asst.Tech. II	100
Anna S. Vikart	Secretary	16 $\frac{1}{2}$
To be recruited	Animal Diener	20

Fringe Benefits

Sub-Total for A

B. Consumable supplies (by major categories)

Dogs at \$25.00 each	\$2500
Surgical supplies, endotracheal tubes, plastic tubing, etc.	500
Radioactive isotopes	1000
Oxygen, miscellaneous gases	200

Sub-Total for B

4,200

C. Other expenses (itemize)

Publication	300
Photography, artist	75
Laboratory tests, nuclear medicine	
laboratory costs	500
Travel to Air Pollution Symposia	500

Sub-Total for C

1,375

Running Total of A + B + C

48,248

D. Permanent equipment (itemize)

Ultrasonic nebulizer	350
Respirator with nebulizer, filter and exhalation manifold	650

Sub-Total for D

1,000

E

7,237

Total request

56,485

E. Indirect costs (15% of A+B+C)

15. Estimated future requirements.

	Salaries	Consumable Suppl.	Other Expenses	Permanent Equip.	Indirect Costs	Total
Year 2	R	4,200	1,375	-	7,589	58,184
Year 3		4,200	1,375	-	7,960	61,031

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5.

16. Other sources of financial support-

List financial support from all sources, including own institution, for this and related research projects.

CURRENTLY ACTIVE

Title of Project	Source (give grant numbers)	Amount	Inclusive Dates
Relation of Lymphatics to Cardiopulmonary Function	Department of Health, Education and Welfare HL 3180-15 (Suppl.)	\$6,795	Jan. 1-Mar. 31, 1973
			After March 31, 1973 we have no funds unless Congress appropriates funds for new 5-year grant. This appears to be doubtful.

PENDING OR PLANNED

Title of Project	Source (give grant numbers)	Amount	Inclusive Dates
Relation of Lymphatics to Cardiopulmonary Function	Department of Health, Education and Welfare HL 3180-15	\$276,759 (First year \$51,044)	Dec. 1, 1973 - Nov. 30, 1978 (Dec. 1, 1973 - Nov. 30, 1974)

N.B. This grant has been awarded and is pending action by Congress and the President
to appropriate the necessary funds.

It is understood that the investigator and institutional officers in applying for a grant have read and accept the Council's "Statement of Policy Containing Conditions and Terms Under Which Project Grants Are Made."

Checks payable to

Mount Zion Hospital & Medical Center

Mailing address for checks

Mr. George A. Thompson, Controller
Mount Zion Hospital & Medical Center
P. O. Box 7921, San Francisco, Ca. 94120

Principal investigator

Typed Name Sanford E. Leeds, M.D.

Signature Sanford E. Leeds Date 2/14/73

Telephone 415

Area Code 415 Number 567-6600 Extension 201

Responsible officer of institution

Typed Name Jay Okun Yedvab,

Title Executive Director

Signature Jay Okun Yedvab Date 2/15/73

Telephone 415

Area Code 415 Number 567-6600 Extension 201

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CURRICULUM VITAE

SANFORD E. LEEDS, M.D.

Date and place of birth :

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Education:

R University of California, A.B.

University of California Medical School, M.D.

1935 - 1936 Intern, San Francisco Hospital, University of California Service

Positions held:

1936 - 1938 Research Associate, Vanderbilt University Medical School, Nashville, Tennessee, with Dr. Alfred Blalock.

1938 - 1941 Assistant Resident and Resident in Surgery, University of California Hospital and UC Service, San Francisco Hospital.

1941 - 1949 Active Duty, U.S. Army, 1st Lt. to Lt. Col., New Guinea and Luzon Campaigns. Col. M.C., USAR, retired in 1968 after 30 years service in active reserve.

1941 - 1952 Clinical Instructor of Surgery.

1952 - Assistant Clinical Professor of Surgery, University of California Medical School.

1952 - Associate Chief of Surgery, In Charge of Cardiac Surgery (1952-63), Mount Zion Hospital and Medical Center.

Present: Assistant Clinical Professor of Surgery, University of California Medical School, San Francisco; Associate Chief of Surgery (1952 - present), and Director, Experimental Surgery Laboratory (1969 - present), Mount Zion Hospital and Medical Center, San Francisco.

Specialty Certification:

American Board of Surgery - 1942
The Board of Thoracic Surgery - 1952

- Professional Societies:

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Curriculum Vitae - Sanford E. Leeds, M.D., continued

CELOWDEN

Author of various papers, to date, January 1973 - 75 papers.

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CURRICULUM VITAE

HERMAN N. UHLEY, M.D.

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Date and place of birth:

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Undergraduate and Graduate Education:

University of Wisconsin
University of Wisconsin School of Medicine

Postgraduate Training:

Internship, Michael Reese Hospital, Chicago, Illinois	1951-52
Research Fellow, Michael Reese Hospital, Chicago, Ill.	1952-53
Resident, Beth Israel Hospital, Boston, Massachusetts	1953-55
Teaching Fellow, Harvard Medical Scool, Boston, Mass.	1953-55
Research Fellow, Harold Brunn Institute, Mount Zion Hospital and Medical Center, San Francisco, California	1955-56

Positions held:

Assoc. Clinical Professor of Medicine, University of California School of Medicine, San Francisco, California.
Asst. Chief of Medicine, Mount Zion Hospital and Medical Center, San Francisco.
Attending Physician, Medicine, V. A. Hospital, San Francisco.
Assoc. Chief of Medicine, In Charge of Department of Electrocardiography, Mount Zion Hospital and Medical Center, San Francisco.
Present: Assoc. Chief of Medicine, and Director, Department of Electrocardiography and Coronary Care Unit, Mount Zion Hospital and Medical Center, San Francisco;
Assoc. Clin. Prof., Medicine, UCSF School of Medicine, San Francisco.

Society Membership:

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Specialty Certification:

American Board of Internal Medicine, 1961

Publications:

Book: Vector Electrocardiography, Lippincott, Philadelphia, Pa., 1962.

Papers: To date, January 1973 - 62 articles.

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HERMAN N. UHLEY, M.D.

LIST OF PUBLICATIONS.

BOOK:

VECTOR ELECTROCARDIOGRAPHY, Lippincott, Philadelphia, Pa., 1962.

PAPERS:

1. Uhley, H.N.: A model for automatic determination of the relationship between the cardiac vector and the three standard limb leads. J. Appl. Physiol. 6:260-262, 1953.
2. Uhley, H.N., M. Friedman, C. Ayello: The atherosclerotic response of "aggressive" and "passive" groups of chickens to cholesterol enriched diet. Proc. Soc. Exper. Biol. Med. 96:244-246, 1957.
3. Friedman, M., H.N. Uhley: Experimental stress, blood lipids and atherosclerosis. In: HORMONES AND ATHEROSCLEROSIS, Chapter 16, pp.205-211, Academic Press, Inc. New York, 1959.
4. DeLong, E., H.N. Uhley, M. Friedman: Change in blood clotting time of rats exposed to a particular forms of stress. Am. J. Physiol. 196:429-430, 1959.
5. Leeds, S.E., H.N. Uhley, J.J. Sampson, M. Friedman: A new method for measurement of lymph flow from the right duct in the dog. Am. J. Surg. 98:211-216, 1959.
6. Uhley, H.N., L.M. Rivkin: Visualization of the left branch of the human atrioventricular bundle. Circulation 20:419-421, 1959.
7. Friedman, M., H.N. Uhley: Role of the adrenal in hastening blood coagulation after exposure to stress. Am. J. Physiol. 197:205-206, 1959.
8. Uhley, H.N., M. Friedman: Blood lipids, clotting and coronary atherosclerosis in rats exposed to a particular form of stress. Am. J. Physiol. 197:396-398, 1959.
9. Uhley, H.N., S.E. Leeds, J.J. Sampson, M. Friedman: Right duct lymph flow in dogs measured by a new method. Dis. Chest 37:532-534, 1960.
10. Uhley, H.N., L.M. Rivkin: Peripheral distribution of the canine A-V conduction system. Observations on the gross morphology. Am. J. Cardiol. 5:688-691, 1960.
11. Uhley, H.N., S.B. Reich, L.M. Rivkin: Radioautography of the conduction system of the dog's heart with I¹³¹. Am. J. Physiol. 198:859-860, 1960.

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12. Rivkin LM, H.N. Uhley: Electrocardiographic alterations induced by incisions in the distal conduction system. *Surg Forum* 11:202-204, 1960.
13. Uhley HN: Study of the transmembrane action potential, electrogram, electrocardiogram and vectorcardiogram of rats with left ventricular hypertrophy. *Am. J. Cardiol.* 7:211-217, 1961.
14. Uhley H.N., S.E. Leeda, J.J. Sampson, M. Friedman: Some observations on the role of the lymphatics in experimental acute pulmonary edema. *Circ. Res.* 9:688-693, 1961.
15. Uhley, H.N., L.M. Rivkin: Electrocardiographic patterns following interruption of main and peripheral branches of the canine right bundle of His. *Am. J. Cardiol.* 7:810-816, 1961.
16. Uhley, H.N., S.E. Leeds, J.J. Sampson, M. Friedman: Role of the pulmonary lymphatics in chronic pulmonary edema. *Circ. Res.* 11:966-970, 1962.
17. Burton S.D., H.N. Uhley, T. Ishida: Technique for recording multiple avian embryonic electrocardiograms. *J. Appl. Physiol.* 18:650-651, 1963.
18. Uhley, H.N., S.E. Leeda, J.J. Sampson, M. Friedman: A technic for collection of right duct lymph flow in unanesthetized dogs. *Proc Soc Exp Biol Med* 112:684-685, 1963.
19. Uhley, H.N., D.E. Bernstein: Termination of ventricular tachycardia by external countershock. *California Med* 98:281-282, 1963.
20. Uhley HN, L.M. Rivkin: Electrocardiographic patterns following interruption of the main peripheral branches of the canine left bundle of His. *Am. J. Cardiol.* 13:41-47, 1964.
21. Uhley, H.N., Lewis, A.E., G.R. Biskind: A simple device for checking the Coulter counter. *Am. J. Clin. Path.* 44:600-601, 1965 (reprinted from *Techn Bull Registry Med Technol Vol.35, No.10, 1955*).
22. Uhley, H.N., L.M. Rivkin: Cardiac slowing induced by external coupled pacing. *Bull New York Acad. Med., 2nd Series*, 41:565-570, No.5, 1965.
23. Rivkin, L.M., H.N. Uhley: Slowing of the heart rate with synchronized delayed single pulse pacing. *Clin. Res.* 13:122, 1965 (abstract).
24. Uhley, H.N., E. Bossi: Rapid mass electrocardiographic screening in college students. *J. Am. Coll. Assn.* 13:341-346, 1965.
25. Uhley, H.N., H.H. Rosenblum: Electrocardiographic limb leads: Suggestion for their logical display. *Am Heart J* 71:571-573, 1966.
26. Rivkin, L.M., H.N. Uhley: Effect on heart rate, atric flow and left ventricular pressure induced by coupled pacing. *Dis Chest* 49:512-515, 1966.

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27. Sampson, J.J., H.N. Uhley, S.E. Leeds, M. Friedman: The relation of pulmonary lymph flow to pulmonary edema: The protective action of an expanded lymph drainage system. Proc. World Congress of Cardiology, New Delhi, India, 1966.
28. Uhley, H.N., S.E. Leeds, J.J. Sampson, N. Rudo, M. Friedman: The temporal sequence of lymph flow in the right lymphatic duct in experimental chronic pulmonary edema. Am. Heart J. 72:214-217, 1966.
29. Cohen, R.A., H.N. Uhley: Monitoring the blood pH in acute myocardial infarction. The role of acidosis in arrhythmia. JAMA 198:947-949, 1966.
30. Uhley, H.N., S.E. Leeds, J.J. Sampson, M. Friedman: Right duct lymph flow in experimental heart failure following acute elevation of left atrial pressure. Circ. Res. 20:306-310, 1967.
31. Leeds, S.E., H.N. Uhley, J.J. Sampson, M. Friedman: Significance of changes in the pulmonary lymph flow in acute and chronic experimental pulmonary edema. Am. J. Surg. 114:254-258, 1967.
32. Friedman, M., H.N. Uhley: Management of coronary heart disease. Postgrad. Med. 42:155-164, 1967.
33. Sampson, J.J., S.E. Leeds, H.N. Uhley, M. Friedman: The Lymphatic System and Pulmonary Disease. In: LYMPH AND THE LYMPHATIC SYSTEM, Charles C Thomas, 1968, Chapter IX, pp.200-212. (Proceedings of the Conference on Lymph and Lymphatic System, New Orleans, December, 1965).
34. Sampson, J.J., S.E. Leeds, H.N. Uhley, M. Friedman, P. Ortega: Studies on the lymph flow and changes in pulmonary structures as indices of circulatory changes in experimental pulmonary edema. Israel J. Med. Sci. 4:116, 1968. (Presented at Fourth Asian-Pacific Congress of Cardiology, Sept.1-7, 1968, Jerusalem and Tel Aviv, Israel.)
35. Uhley, H.N.: The use of 6-channel ECG recorders in improving the efficiency of an Electrocardiography department. J. Electrocardiography, 2:69-72, 1969.
36. Uhley, H.N., S.E. Leeds, J.J. Sampson, M. Friedman: The cardiac lymphatics in experimental chronic congestive failure. Proc. Soc. Exper. Biol. Med. 131:379-381, 1969.
37. Uhley, H.N.: A new simple model for the synthesis of the electrocardiogram. Circulation 40:173-178, 1969.
38. Ziperovich, S., H.N. Uhley, H.W. Paley: Coronary nodal rhythm following open heart surgery. Dis. Chest 55:219-223, 1969.

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39. Sampson, J.J., S.E. Leeds, H.N. Uhley, M. Friedman, P. Ortega: Studies of lymph flow and changes in pulmonary structures as indexes of circulatory changes in experimental pulmonary edema. Israel J. Med. Sci. 5:826-830, 1969.
40. Uhley, H.N.: Electrical monitoring of the acutely ill patients. Geriatrics 25:145-150, 1970.
41. Uhley, H.N.: A simple means of determining blood loss in urinary drainage. J. Urology 104:328-329, 1970.
42. Ortega, P., H.N. Uhley, S.E. Leeds, J.J. Sampson: Electronic and light microscopy studies of progressive pulmonary edema in experimental heart failure in the dog (with special reference to expansion of pulmonary lymph flow with congestive heart failure). In: PROGRESS IN LYMPHOLOGY II. Georg Thieme Verlag, Stuttgart, 1970, pp.15-20. 32-33. (Selected papers of the Second International Congress of Lymphology, Miami, USA, March 15-20, 1968).
43. Leeds, S.E., H.N. Uhley, J.J. Sampson, M. Friedman: Changes in the pulmonary lymph flow in acute and chronic experimental pulmonary edema. In: PROGRESS IN LYMPHOLOGY II. Georg Thieme Verlag, Stuttgart, 1970, pp.261-264. (Selected papers of the Second International Congress of Lymphology, Miami, USA, March 15-25, 1968).
44. Ortega, P., H.N. Uhley, S.E. Leeds, M. Friedman, J.J. Sampson: Serial electron and light microscopic studies on the dog lung in chronic experimental pulmonary edema. J. Path. 60:57-74, 1970.
45. Uhley, H.N.: Electrocardiographic telemetry from ambulances. A practical approach to mobile coronary units. Am. Heart J. 80:838-842, 1970.
46. Leeds, S.E., H.N. Uhley, J.J. Sampson, M. Friedman: The cardiac lymphatics after ligation of the coronary sinus. Proc. Soc. Exper. Biol. Med. 135:59-62, 1970.
47. Uhley, H.N., A.E. Brown, M. Friedman, H. Rosenblum, S.R. Sherman, F.F. Stucki, J.T. Wilson: Automatic surveillance of rate, rhythm and T wave contour: the concept of monitoring large number of patients. Am. J. Cardiol. 26:375-378, 1970.
48. Leeds, S.E., H.N. Uhley, J.J. Sampson, M. Friedman: Measurement of lymph flow of the heart. Abstract in Program of 3rd International Congress of Lymphology, Brussels, Aug.27-Sept. 1, 1970.

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49. Leeds, S.E., H.N. Uhley, E.H. Rosenbaum, C.M. Basch, J.M. Yoffey: Comparative studies of lymph and lymphocytes of the thoracic and right lymphatic ducts in normal dogs collected in five hourly periods. Abstract in Program of the 3rd Internat. Congress of Lymphology, Brussels, Aug.27-Sept 1, 1970.
50. Leeds, S.E., S.B. Reich, H.N. Uhley, J.J. Sampson, M. Friedman: The pulmonary lymph flow after irradiation of the lungs of dogs. Chest 59:203-207, 1971.
51. Leeds, S.E., S.B. Reich, H.N. Uhley, J.J. Sampson, M. Friedman: The pulmonary lymph flow after irradiation of the lungs of dogs. (Review of publication in Chest, abstract and reviewed by Dr. R.G.Fraser) Invest. Radiology 6:440, 1971.
52. Uhley, H.N.: Telemetry in mobile coronary care. Med Opinion & Review 7:52-54, 1971.
53. Uhley, H.N., S.D. Burton, A.E. Lewis, T. Ishida: Electrocardiographic monitoring of the embryonic duck heart Digitoxin assay. J. Biomed. Systems 2:10-13, 1971.
54. Leeds, S.E., H.N. Uhley: Measurement of lymph flow of the heart. Lymphology 4:31-34, 1971.
55. Leeds, S.E., H.N. Uhley, C.M. Basch, E.H. Rosenbaum, J.M. Yoffey: Comparative study of lymph and lymphocytes of the chronic and right lymphatic ducts. I. Normal dogs. Lymphology 4:53-57, 1971.
56. Uhley, H.N., S.E. Leeds, M.-A. Sung: The subendocardial lymphatics in the genesis of conduction disturbances and arrhythmias. Am J Cardiol 29:367-371, 1972.
57. Uhley, HN: Some controversy regarding the peripheral distribution of the conduction system. Am J Cardiol 1972 (accepted for publication).
58. Uhley HN: The quadrifascicular nature of the peripheral conduction system. In: Cardiac Arrhythmias. LS Dreifus and W Likoff, eds., 1972 (accepted for publication).
59. Hecht H et al: Conduction system nomenclature. Am. J Cardiol 1972, (accepted for publication).
60. Uhley HN: Automatic monitoring in the hospital. Hospital Practice 1972, (accepted for publication).
61. Uhley HN: Monitoring of the surgical patient. Contemporary Surgery 1972, (accepted for publication).
62. Uhley HN: Fascicular block (in preparation for Cardiac Clinics).

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CURRICULUM VITAETHEODORE N. FINLEY, M.D.Date and place of birth

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Education and training :

University of Washington B.S.(Chemistry)
 Johns Hopkins Medical School M.D.
 Internship: San Francisco County Hospital
 Residency : University of California Medical Center
 and San Francisco County Hospital

Scholarships or Fellowships held:

Research Fellow, University of Buffalo, Dept. Physiology 1957-1958
 Research Fellow, American Trudeau Society, University of California 1958-1961

Positions held:

Clinical Instructor in Medicine, Cardiovascular Research Institute, University of California Medical Center 1958-1961
 Assistant Professor of Anesthesiology, Physiology and Biophysics, and Director of Anesthesiology Research, University of Washington School of Medicine 1961
 Associate Professor, University of Washington School of Medicine 1964 (July)
 Associate Professor of Medicine, University of New Mexico School of Medicine Sept. 1964-1968 (June)
 Associate Chief of Medicine and Director, Pulmonary Laboratory, Department of Medicine, Mount Zion Hospital & Medical Center June 1968-present
 Associate Clinical Professor, University of California Medical Center, San Francisco June 1968-present
 Medical Director, Inhalation Therapy, Mount Zion Hospital and Medical Center 1968-present

Research appointments: see aboveBoard Certification: Qualified for Internal MedicineProfessional and Scientific Memberships:

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THEODORE N. FINLEY, M.D.

BIBLIOGRAPHY

1. Finley TN, Lenfant C, Haab P, Pilper J, Rahn H: Venous admixture of pulmonary circulation of anesthetized dog. *J Appl Physiol* 15:419, 1960.
2. McIlroy MB, Butler J, Finley TN: Effects of chest compression on reflex ventilation drive and pulmonary function. *J Appl Physiol* 17:701, 1962.
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Residency : San Francisco General Hospital;
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Positions held:

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Hematology Fellow, Blood Research Laboratories, New England Center Hospitals, Boston, Mass.	1959 - 1961
Massachusetts Institute of Technology - Courses in Molecular Genetics, Radioisotopes, Immunology and Biochemistry	1961 - 1962
Instructor of Clinical Medicine, University of California School of Medicine, San Francisco, Ca.	1966 - present
Director, Medical Cancer Service, Mount Zion Hospital and Medical Center	1968 - 1971
Associate Chief of Medicine, Chief, Clinical Immunology, Department of Medicine, and Director, Immunology Research Laboratory, Mount Zion Hospital and Medical Center	1971 - present

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Mary Hitchcock Memorial Hospital, Hanover, N.H. 1962-1963
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Fellowship

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Fellow, Pulmonary Laboratory, Mount Zion Hospital
and Medical Center, San Francisco, Ca. 1968-1970

Appointments

National Institutes of Health
Division of Anesthesiology 1963-1968
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Adjunct in Medicine, Mount Zion Hospital
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Anesthesiologist, St. Joseph Hospital,
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Degrees

B.Sc. - American University of Beirut 1957
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Societies (Honorary)

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Professional Organizations

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Assistant Professor of Radiology, Asst. Radiologist, University of California School of Medicine	1960-66
Associate Professor of Radiology, Assoc. Radiologist, University of California School of Medicine	1966
Associate Professor of Radiology, University of Kentucky	1966-67
Assoc. Director, Claire Zellerbach Saroni Tumor Institute, Mount Zion Hospital and Medical Center	1967-72
Assoc. Chief, Department of Laboratory and Pathology Medicine, and Director, Division of Nuclear Medicine, Mount Zion Hospital and Medical Center	1972-present
Associate Clin. Professor of Radiology, University of California School of Medicine	1967-present

Consultant:

U. S. Naval Hospital, Oak Knoll, Oakland, California	1964-66
Atomic Energy Commission	1964-present
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